

still more different from those of *T. burmeisteri*. The external incisors are, on the other hand, more like those of the latter species in their triangular form, though their inner angle is not produced as in that species.

*Explanation of Plate.*

The figures represent the *Stereosferum tumidum* in various pieces ; all of the natural size excepting fig. 1, which is three-fourths natural size.

Fig. 1. The typical specimen on a slab of calcareous shale of the carboniferous formation ; the anterior part of the skeleton wanting ; viewed from below. *nc*, notochordal canal exposed by the splitting of the vertebral centrum.

Fig. 2. Vertebrae in a piece of weathered rock of darker color than the slab.

Fig. 3. A lumbar vertebra from the piece of matrix represented in fig. 2, anterior view ; *a*, inferior view

Fig. 4. A caudal vertebra from the same piece of stone, left side ; *a*, inferior side.

Fig. 5. A dorsal vertebra with proximal portions of ribs embracing the centrum ; from a different piece of matrix.

Fig. 6. A vertebra of uncertain position, with descending processes, anterior view ; *a*, the same lateral view.

Fig. 7. Humerus, the proximal portion represented by a mould ; from a separate piece.

Fig. 8. Coracoid bone from a separate piece.

All the specimens are preserved in Museo Nacional of Rio Janeiro, excepting that represented in fig. 1, which is in the collection of Madame Ribeira de Andrada.

*Some new Hypotrichous Infusoria. By Dr. Alfred C. Stokes.*

(Read before the American Philosophical Society, June 19, 1885.)

Wet Sphagnum seems to be a favorite haunt for certain fresh-water protozoa. Dr. Leidy found it an unfailing source of supply for many of the Rhizopoda, some of the most interesting forms described by that illustrious naturalist being obtained from a little bunch of the moss. In my own vicinage the beautiful plant is comparatively rare, but a single marsh of not extended dimensions does happily exist here, with the pale Sphagnum in some abundance greenly glimmering beneath the shallow water, while the shadows of elder, azalea and serviceberry, and the broad leaves of tangled smilax vines make the neighboring thicket dim and cool even when the hot sun smites the furrowed field that borders it. Among these pleasing surroundings the Rhizopoda are in numbers excelled only by the Infusoria, as the following previously undescribed forms testify. And it is

a fact worthy of note that the greater proportion of the Infusoria thus far there obtained belong to one family, the Oxytrichidæ of Ehrenberg.

With the exception of certain forms mentioned in this paper, there are but four genera included in the Oxytrichidæ without that posterior cluster of appendages named from their position the anal styles. Their presence or absence is therefore of diagnostic value. It is their absence that separates *Hemicycliostyla* from *Urostyla*, which it otherwise closely resembles, even in form and movements. Its position in the family group is evidently lower than that of *Urostyla*, simply because these posterior ventral appendages have not been developed.

*Hemicycliostyla* (*ἡμικυκλιος*, *semicircular*; *στυλος*, *a style*), gen. nov. Animalcules free-swimming, more or less elongate-ovate, soft, flexible and elastic, the extremities rounded; frontal styles twenty or more, arranged in two more or less semicircular rows; adoral ciliary fringe beginning near the center of the right-hand side of the peristome-field; ventral surface entirely clothed with fine setæ arranged in closely approximated longitudinal rows; anal styles absent; contractile vesicle single or double; nucleus multiple.

*Hemicycliostyla sphagni*, sp. nov. (Fig 1). Body elongate-ovate, soft, flexible and extensile, four times as long as broad, widest behind the center; tapering to the rounded posterior extremity and to the convex, narrower frontal extremity which is curved toward the left-hand side; frontal styles about twenty, in two semicircular rows; marginal setæ not differing from the ventral, scarcely projecting beyond the body-margin except at the posterior border; peristome-field confined to the anterior third of the ventral surface, the right-hand margin ciliate and bearing a membrane; adoral cilia short; nucleus multiple, the nodules ovate or subspherical, small, numerous and scattered; contractile vesicle double, spherical, placed near the left-hand side of the anterior body-half; anal aperture dorsal, near the posterior extremity; parenchyma vacuolar; hispid dorsal setæ small. Length of body 1-50 to 1-60 inch. Habitat.—Marsh water, with *Sphagnum*.

There is another form (Fig. 2) resembling this in a general way, but readily distinguishable from it, not only in shape and size, but chiefly by the presence of a single contractile vesicle, the greater abundance of the nuclear nodules, the absence of vacuolar spaces within the endoplasm, and the development of a conspicuous series of par-oral cilia on the inner edge of the left-hand border of the peristome-field. The body is also less extensile than in *H. sphagni*, and the Infusorian is somewhat less active in its movements. In both the endoplasm is usually made dark and almost opaque by the great quantity of granular matter crowding it centrally.

*Hemicycliostyla trichota*, sp. nov. (Fig. 2). Body elongate-ovate, somewhat extensile, about three times as long as broad, widest posteriorly, tapering to the anterior extremity, which is slightly curved toward the left-hand side; frontal styles and ventral setæ essentially as in *H. sphagni*; peristome-field confined to the anterior half of the ventral surface, a series

of par-oral cilia developed on the left-hand margin, a membrane and a præ-oral ciliary fringe on the right-hand border; nucleus multiple, the nodules small, ovate or sub-spherical, scattered throughout the entire body; contractile vesicle single, spherical, near the center of the left-hand side of the peristome-field; immotile hispid dorsal setæ very small and fine; parenchyma not vacuolar. Length of body 1-60 inch. Habitat.—Marsh water, with Sphagnum.

In *Urostyla gigas* (Fig. 3) we have the largest member of the genus and a giant among Infusoria. Its movements too are correspondingly slow, with much doubling and twisting of the body. And its appetite seems also in proportion to its size, very little that can be forced through the oral aperture coming amiss, even angular grains of sand being occasionally swept into the endoplasm.

The parenchyma is as conspicuously vacuolar as in *Hemicycliostyla sphagni*, the trabecular structure being most extensively developed at the extremities. This condition is constant, none of the numerous individuals observed being without it. In appearance it resembles the similar condition of the parenchyma in *Loxodes rostrum* Ehr. and *Trachelius ovum* Ehr., probably being nearer that of the former, inasmuch as the pseudo-cellular structure does not vary in the same individual, at least while under observation, whereas in *Trachelius ovum* changes in size, position and arrangement of the trabeculæ are frequently made under the eye of the investigator, and two individuals are seldom captured with precisely the same plan of vacuolar distribution. But with *U. gigas* from this vicinity, one arrangement seems quite general and constant. Whether this will obtain in others from a different locality is conjectural.

The nuclei are wonderfully numerous. I have found it impossible to count them with the same result twice in succession, since they are not only irregularly distributed in different planes, but because the animalcule's writhing and twisting movements make such attempts impracticable. They number, however, from forty to sixty. That they are connected by a funiculus, either in the present forms or in *Hemicycliostyla sphagni* or *H. trichota*, I have been unable to ascertain. But if a connecting thread exists, it must be very frail, since the nuclear nodules float out freely and separately from the disintegrated dead body.

Aside from these peculiarities the Infusorian can be easily recognized by the arrangement of the double row of curved vibratile setæ on the posterior extremity. They add much to the creature's attractiveness, and when quiescent are about the first part of the great Infusorian to catch the eye.

*Urostyla gigas*, sp. nov. (Fig. 3). Body elongate, extensile, very soft and flexible, when extended five times as long as broad, widest centrally, tapering toward both extremities, the posterior rounded and slightly curved toward the left-hand side, the anterior narrower, rounded and curved toward the right-hand side; frontal styles five or six; ventral setæ clothing the entire lower surface in closely approximated lines; anal styles six, small, slender, fimbriated, not projecting beyond the body; marginal

setæ longest and most abundantly developed about the posterior extremity, the right-hand border of which bears two oblique rows of long arcuate vibratile setæ, one series originating on the dorsal surface; peristome-field confined to the anterior one-fourth of the ventral surface, the right-hand border ciliate, and an endoral series depending centrally; contractile vesicle single, spherical, on the left-hand side of the peristome-field; nucleus multiple; anal aperture opening on the dorsal surface at some distance from the posterior extremity; parenchyma vacuolar; hispid immotile dorsal setæ short. Length of extended body 1-30 inch. Habitat.—Marsh water, with Sphagnum.

Another species of this same genus (Fig 4), resembling the preceding, yet sufficiently dissimilar to warrant the formation of a new specific title for its reception, is not uncommon in the Sphagnum. It, too, is comparatively gigantic, but the general aspect, aside from minute structural characteristics, renders it readily recognizable. The posterior portion is prolonged as a broad tail-like continuation, a feature thus far restricted to this member alone of the *Urostylæ*. The right-hand postero-lateral border of this part supports a single series of long arcuate setæ similar to the double row on *U. gigas*, the contractile vesicles are ten to twelve in number, and the peristomal structure is distinctive. To accurately ascertain the number of the pulsating vacuoles is almost as difficult as to count the number of nuclear nodules, but there are not less than ten nor more than twelve, their presence at once separating the Infusorian from all the species and making necessary a slight change in the generic diagnosis as it now stands. This form I have named *Urostyla caudata*.

*Urostyla caudata*, sp. nov. (Fig. 4). Body elongate-elliptical, soft, flexible and extensile, five times as long as broad, widest centrally, the anterior extremity rounded and curved toward the left-hand side, the posterior portion narrowed into a straight, broad tail-like prolongation; frontal styles about twenty; ventral setæ clothing the entire ventral surface in closely approximated longitudinal lines; anal styles eight to ten, long, slender, in an oblique row, usually projecting beyond the body; marginal setæ projecting posteriorly and developed on the right-hand border of the posterior extremity as a single oblique series of long arcuate setæ; peristome-field confined to the anterior third of the lower surface, the left-hand margin finely ciliate in addition to the adoral fringe, the right-hand border bearing a membrane and a præ-oral ciliary series; nucleus multiple, the nodules numerous, scattered; contractile vesicles multiple, arranged in a row along the left-hand body-margin; parenchyma vacuolar; anal aperture opening on the dorsal surface near the posterior extremity. Length of body 1-40 inch. Habitat.—Marsh water, with sphagnum.

Previously to the capture of the three forms of *Holosticha* here referred to, but a single fresh-water species had been recorded. The structure of these additional sweet-water members of the genus will necessitate a change in the generic description, since the peristomal membrane, the increased number of frontal styles in *H. hymenophora* and *H. similis*, and the double



Fig. 1

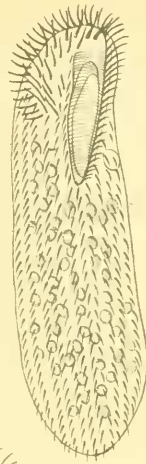


Fig. 2



Fig. 3



Fig. 4



Fig. 5



Fig. 6



Fig. 7



Fig. 8



Fig. 9



Fig. 10



Fig. 11

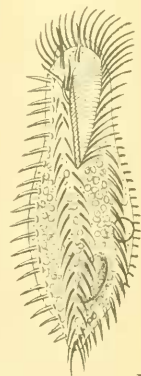


Fig. 12



Fig. 13



contractile vesicle of the former, have not been previously noticed, while a moniliform nucleus is thus far restricted to *H. similis*.

*Holosticha caudata*, sp. nov. (Fig. 5). Body elongate, eight times as long as broad, soft and flexible, widest centrally, constricted near the apical extremity of the peristome-field, widened anteriorly, tapering posteriorly in a tail-like prolongation, the tip somewhat dilated and curved toward the right-hand side; anterior border rounded, lip narrow, crescentic; frontal styles three; ventral setæ in two straight median rows, those on the right-hand side largest; anal styles five, slender, the extremities often fimbriated; marginal setæ numerous, large, flattened, projecting and most abundantly developed at the posterior border; peristome-field confined to the anterior one-fifth of the ventral surface, the right-hand margin finely ciliate and bearing an undulating membrane; contractile vesicle single, spherical, near the left-hand side of the apical extremity of the peristome; anal aperture dorsal near the beginning of the tail-like prolongation; immotile dorsal hispid setæ numerous, long and fine. Length of body 1-50 inch. Habitat.—Marsh water, with Sphagnum.

In *Holosticha hymenophora* (Fig. 6), a sub-terminal anal aperture exists and has been noticed several times, but whether on the ventral or dorsal surface was impossible to positively determine, as the Infusorian in each instance happened to be rapidly rotating on the long diameter, and the aperture opened and closed before the focus could be changed. My impression, however, is that it is dorsal, and I have no hesitation in predicting that the cytophyge will be observed in that position, not only among those described in this paper where the dorsal position is the rule, but with many of the Hypotricha, even with those common and seemingly best-known forms in which so important a structural point ought to have been observed long ago. An instance occurs in *Oxytricha platystoma* (Ehr.) S. K., where the writer has seen the anal aperture on the dorsal surface at the left-hand side of the median line and some distance from the posterior extremity. That it should become developed on the upper surface is certainly a satisfactory and a beautiful adaptation. The lower aspect is needed for the support of the ambulatory organs and anal styles, the posterior extremity is occupied by a luxuriant growth of marginal setæ, with usually one or more supplementary rows of similar appendages, while the dorsum is either entirely naked or only the bearer of immotile hispid hairs, which can be temporarily crowded out of position, or even permanently displaced, without inconvenience or injury to the Infusorian.

*Holosticha hymenophora*, sp. nov. (Fig. 6). Body elliptical, three to four times as long as broad, soft, flexible and somewhat extensile, narrowed anteriorly and slightly curved toward the left-hand side; lip prominent, crescentic; frontal styles five; ventral setæ in two straight closely approximated median rows; the left-hand series beginning at the apical extremity of the peristome; anal styles five, straight, slender, in an oblique row, the first or right-hand one slightly projecting beyond the body; marginal setæ longest and projecting posteriorly; peristome-field extending for one-third

the length of the body, the right-hand border nearly straight, finely ciliate and bearing an undulating membrane; contractile vesicle double, near the center of the left-hand body-margin; nucleus double, ovate; anal aperture sub-terminal, presumably dorsal; immotile hispid dorsal setæ short. Length of body, 1-125 to 1-150 inch. Habitat.—Shallow pools in early spring.

The form which I have named *Holosticha similis* (Fig. 7), is readily differentiated from all other species by the moniliform nucleus. Usually the nodules are arranged in a single row, but individuals occur not uncommonly with a double row, all the component nodules of each series then being in contact laterally. Here also the anal aperture is dorsal.

*Holosticha similis*, sp. nov. (Fig. 7). Body elongate-ovate, soft, flexible and somewhat extensile, more than four times as long as broad, the posterior extremity rounded, the anterior narrower, rounded, slightly curved toward the left-hand side; peristome-field oblique, confined to the anterior third of the lower surface, narrow, ovate, the right-hand margin ciliate; frontal styles about fourteen; ventral setæ in two straight median rows; anal styles twelve to fourteen, slender, in a long oblique row, only the most posterior ones projecting beyond the body; marginal setæ conspicuous, longest, most abundantly developed and projecting at the posterior border; contractile vesicle single, spherical, on the left-hand side of the apical termination of the peristome-field; nucleus moniliform, the nodules ovate or subspherical, in a single or double row, placed near the left-hand body-margin; anal aperture dorsal, near the posterior extremity; dorsal immotile hispid setæ small and fine. Length of body, 1-130 inch. Habitat.—Marsh water, with Sphagnum.

The following animalcule is rather slow in its movements, especially when in contact with débris or algal filaments, then resting for a time, commonly with the dorsal surface upward, a position giving the observer an opportunity to study the numerous hispid setæ projecting from that part, but effectually concealing the more important arrangement of ventral styles and setæ. When it has reversed its position, the ventral setæ are seen to conspicuously differ in size in the two median rows, as well as in numbers. This difference is not uncommon in members of its genus (*Uroleptus*), but here it is unusually well marked. A similar difference also exists between the right and left-hand marginal setæ, the former being abundant and remarkably flat. This is unusual.

In many Infusoria the body is prolonged anteriorly as a narrow crescent, usually styled the upper lip. In many of these I believe this to be a continuation of the ventral plane and consequently to be in reality a lower lip. Such is the case with *Uroleptus dispar*, as shown in diagrammatic outline in figure 9.

*Uroleptus dispar*, sp. nov. (Figs 8 and 9). Body elongate-oblongate, elastic, four to five times as long as broad, widest centrally, tapering posteriorly and terminating in a narrow, flattened, tail-like prolongation; anterior region depressed; frontal border rounded, the ventral surface



prolonged anteriorly as a short, projecting crescentic lip; peristome-field extending for about one-third the entire length of the body, the right-hand border ciliate and apparently having a narrow band-like undulating membrane; ventral setæ in two median lines continued to the termination of the caudal prolongation, those of the right-hand series largest and most numerous; marginal setæ large, projecting beyond the body-margin anteriorly on the right-hand side, and about the caudal extremity where they are longest and most abundantly developed, those of the right-hand body margin largest and conspicuously flattened; frontal styles three; contractile vesicle single, spherical, near the center of the left-hand border; nucleus double, ovate; dorsal aspect bearing a median and an uninterrupted marginal series of immotile hispid setæ; anal aperture opening on the dorsal surface near the beginning of the caudal prolongation. Length of body, 1-180 to 1-150 inch. Habitat.—Fresh water.

Another member of the preceding genus, whose habitat is the Sphagnum swamp, is so distinctive in form that the diagnosis and figure (Fig. 10) are alone needed for its recognition. It is one of the most active of all the usually frisky members of the genus, darting out of the field, frequently swimming backward at the moment, so as to make its study rather difficult. It is very flexible and elastic, and at the same time one of the brightest, most graceful and beautiful of the handsome group. The extended body is delineated, in Fig. 10, as well as the absence of color, life and motion permit.

*Uroleptus longicaudatus*, sp. nov. Body narrowly sub-fusiform, elongate, about eight times as long as broad, extensile, widest centrally, tapering posteriorly to a long, narrow, attenuate tail-like prolongation forming one-third the length of the entire body; anteriorly constricted into a neck-like portion, the frontal region expanded and rounded; lip narrowly crescentic; frontal styles three; marginal setæ large, flattened, projecting, longest and most abundantly developed about the caudal prolongation and posterior extremity; ventral setæ in two closely approximated median rows, one only continued through the caudal prolongation; peristome-field confined to the anterior fifth of the lower surface, the right-hand border bearing a narrow membrane; contractile vesicle single, spherical, near the left-hand border of the neck-like constriction; nucleus double, ovate; anal aperture dorsal, near the beginning of the tail-like prolongation; hispid dorsal setæ forming several longitudinal rows. Length of extended body, 1-120 inch. Habitat.—Marsh water, with Sphagnum.

Among the Hypotrichous Infusoria canal-like contractile vesicles are comparatively rare, but a spherical pulsating vacuole with canal-like diverticula, somewhat resembling that of *Stentor*, has been observed only in the animalcule here referred to under the name of *Eschaneustyla brachytona*. In *Spirostomum* the canal-like contractile vesicle possesses an enlargement at its posterior termination; in *Stentor* the single spherical vacuole gives off one branch which encircles the peristome-field, and another that extends along one lateral border, thus presenting a likeness to what obtains in this

Hypotrichous animalcule, where the pulsating channel is interrupted by two spherical vacuoles.

The proper position of the following Infusorian in a scheme of classification would probably be before the next one to be noticed, both then immediately preceding Uroleptus. From both the genera the anal styles are absent, and in *Eschaneustyla* the ventral setæ, which are of vital importance in generic diagnosis, exhibit an arrangement not previously observed in the family group. In form it most nearly approaches *Urostyla*, for which it might readily be mistaken under insufficient amplification.

*Eschaneustyla* (*εσχατια*, the furthest part; *ανευ*, without; *στυλος*, a style), gen. nov. Animalcules free-swimming, elliptical or ovate, not encuirassed; frontal styles numerous, more or less uncinatè; ventral setæ in three unequal longitudinal lines; anal styles none; marginal setæ uninterrupted; contractile vesicle canal-like, near the left-hand border. Inhabiting fresh water.

*Eschaneustyla brachytona*, sp. nov. (Fig. 11). Body elongate-ovate, soft, flexible and somewhat extensile, three and one-half to four times as long as broad, both extremities usually rounded, the anterior the narrower, somewhat curved toward the left-hand side, a slight constriction beneath the frontal border; peristome-field arcuate, narrow, oblique, confined to the anterior third of the ventral surface, the posterior termination widest, deepest and curved toward the right-hand side, the right-hand border finely ciliate; frontal styles about twenty-five, in oblique lines, two or three supplementary styles forming the first row; ventral setæ in three unequal series, the right-hand row shortest, the central line longest but not extending to the posterior extremity; no anal styles; marginal setæ uninterrupted, longest and projecting at the posterior border only; contractile vesicle canal-like, extending along the entire left-hand body-margin, interrupted anteriorly by two spherical or subfusiform dilatations, one near the posterior termination of the peristome-field, the other near the center of the lateral body margin; nucleus not observed; anal aperture postero-terminal. Length of body, 1-112 to 1-150 inch. Habitat.—Standing water, with dead leaves.

The last form to be here mentioned is one apparently bridging the space between *Holosticha* and *Uroleptus*. In general appearance, in the arrangement of the ventral appendages and the conspicuously flattened marginal setæ it recalls the latter. The caudal appendage is not constant, therein differing from and separating the Infusorian from the invariably caudate *Uroleptus*. In this soft and variable posterior extremity it has a peculiarity not possessed by the remainder of the body, and not possessed by any member of the highly organized group to which the creature belongs. This posterior extremity is changeable in form. When first observed the part may be conspicuously bifid, soon to give place to an obtusely pointed, a truncate or an evenly rounded tip, or, as seen in a single instance and illustrated in figure 13, one point of the bifurcation may be extended in a way to suggest a pseudopodium, with a bulbous termina-